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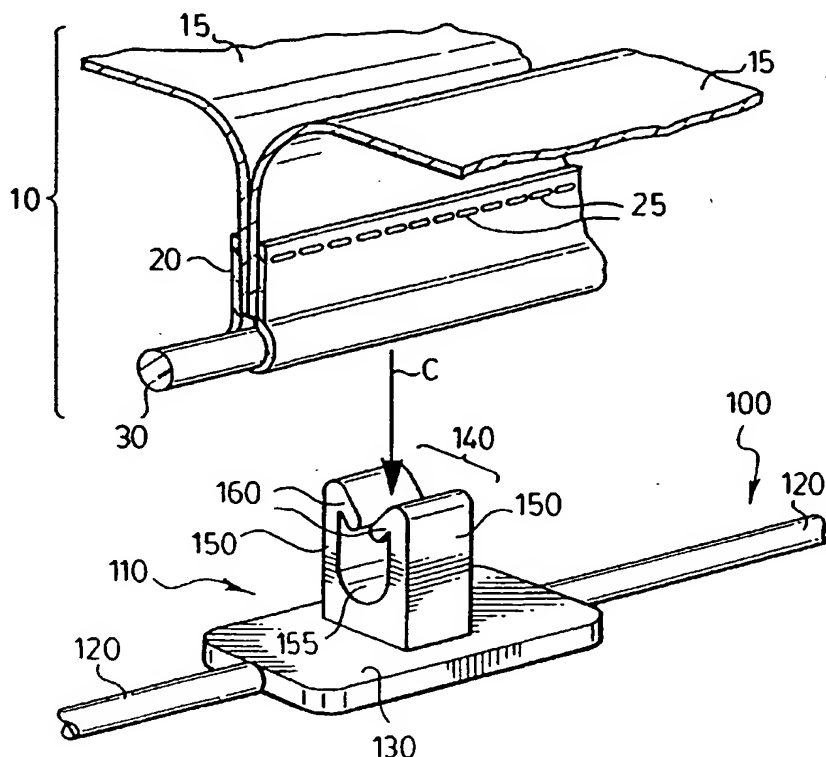
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[Continued on next page]

(54) Title: ATTACHMENT DEVICE



(57) Abstract: In one of its aspects, the present invention relates to an attachment device (100) which comprises a series of attachment portions (110). The attachment portions (110) are interconnected to one another by at least one connecting portion (120), preferably a flexible connecting portion (120). The attachment device (100) is flexible in at least two independent planes (#1, #2). In most cases, the present attachment device (100) will be flexible in more than two independent planes. A preferred manner by which such flexibility is conferred to the attachment device is by the provision of a trim cover attachment portion (110) having a female attachment portion (140) attached to a base portion (130). The base portion (130) has a larger surface area than the surface area of the female attachment portion (140) adjacent or attached thereto. The lateral dimension of the base portion (130) is greater than the lateral dimension of the at least one connecting portion (120). A process of producing a resilient device (e.g., a foam element for use in a vehicular seat) is also described as is a mold (60) for carrying out such a process. The present

attachment device (100) is particularly well suited for attaching a trim cover (10) to a resilient (e.g., foam) body (50) to produce a vehicular seat or a component of a vehicular seat. Other applications of the present attachment device are also contemplated.

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## INTERNATIONAL SEARCH REPORT

International Application No

PCT/CA 03/00246

A. CLASSIFICATION OF SUBJECT MATTER  
 IPC 7 B60N2/58 A47C31/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched .

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 298 22 649 U (FEHRER F S GMBH & CO KG) 8 April 1999 (1999-04-08)	1-9,11, 13,14, 49,50, 52-54
A	page 8, lines 15-18; claims 1,2,4,5; figures 1,2,6	12, 15-25,51
X	DE 199 49 423 C (FEHRER F S GMBH & CO KG) 25 January 2001 (2001-01-25) claims; figures	1,2,10, 13
P,X	US 2002/101109 A1 (STILLER EDWIN L ET AL) 1 August 2002 (2002-08-01) abstract; figures	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

## \* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"Z" document member of the same patent family

Date of the actual completion of the international search

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# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/CA 03/00246

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-25, 49-54

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-25,49-54

An attachment device comprising female attachment portions interconnected to one another by at least on connecting portion, the attachment device being flexible in two planes, the female portion comprising a receptacle and a base with a lateral dimension greater than the receptacle one and wherein a connecting portion interconnects a pair of attachment portions at a pair of rotatable joints.

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2. claims: 26-48

A process for producing a foam device comprising the step of disposing the attachment device in a mold with first and seconds portions engageable to define a mold cavity.

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## INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
DE 29822649	U	08-04-1999	DE 29822649 U1	08-04-1999
DE 19949423	C	25-01-2001	DE 19949423 C1	25-01-2001
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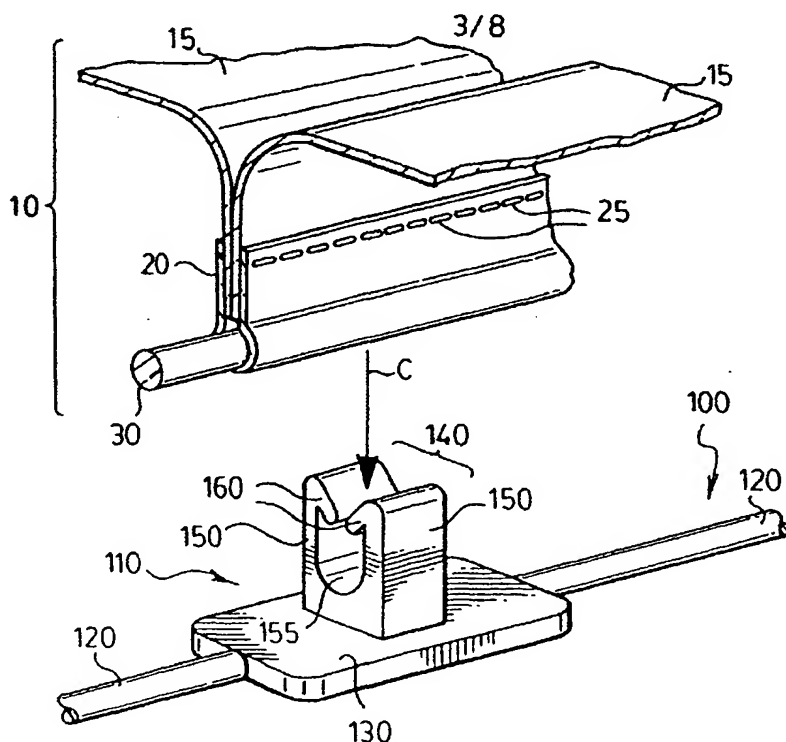
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[Continued on next page]

(54) Title: ATTACHMENT DEVICE



(57) Abstract: In one of its aspects, the present invention relates to an attachment device which comprises a series of attachment portions. The attachment portions are interconnected to one another by at least one connecting portion, preferably a flexible connecting portion. The attachment device is flexible in at least two independent planes. In most cases, the present attachment device will be flexible in more than two independent planes. A preferred manner by which such flexibility is conferred to the attachment device is by the provision of a trim cover attachment portion having a female attachment portion attached to a base portion. The base portion has a larger surface area than the surface area of the female attachment portion adjacent or attached thereto. The lateral dimension of the base portion is greater than the lateral dimension of the at least one connecting portion. A process of producing a resilient device (e.g., a foam element for use in a vehicular seat) is also described as is a mold for carrying out such a process. The present attachment device is particularly well suited for attaching a trim cover to a resilient (e.g., foam) body to produce a vehicular seat or a component of a vehicular seat. Other applications of the present attachment device

are also contemplated.

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## ATTACHMENT DEVICE

### TECHNICAL FIELD

In one of its aspects, the present invention relates to an attachment device, preferably to a trim cover attachment device. In another of its aspects, the present invention relates to a resilient device, preferably a foam device in a vehicular seat, incorporating the present attachment device, preferably for attachment of a trim cover to the foam device. In yet another of its aspects, the present invention provides a process for producing a resilient device, preferably a foam device in a vehicular seat, incorporating the present attachment device, more preferably a trim cover attachment device. In yet another of its aspects, the present invention provides a mold for producing a resilient device, preferably a foam device in a vehicular seat, incorporating the present attachment device, preferably for attachment of a trim cover to the foam device.

### BACKGROUND ART

Attachment of a trim cover to a resilient device is generally known.

In most cases, the resilient device is a foam device, although, in some cases, a fibrous matrix such as rubberized horsehair and the like is still being employed. Typically, it is desired to secure a trim cover to a resilient device to produce a vehicular seat or a component of a vehicular seat.

There are three general categories of approaches in attachment of a trim cover to a resilient device: adhesive, foam-in-place and mechanical. The present invention relates to an improvement falling in the latter category and thus, prior art in this category will be discussed.

In the mechanical approach for attachment of a trim cover to a resilient device, there are (at least) four sub-categories. For ease of description, reference will be made to a foam device.

First, it is known in art to employ so-called "hog-rings" to secure a trim cover to a resilient device. In this approach, a metal wire is molded into the so-called A-surface of the foam device. The metal wire is exposed at selected spots,

typically in a trench, on the surface of the foam device. A trim cover is provided and has a finished outer surface made of leather, cloth, vinyl or the like. Commonly attached to the underside of the trim cover is a non-woven material, a felt material and the like. A hard plastic (or other) bead is attached to the non-woven material.

5 Of course other methods of attaching the hard plastic bead to the trim cover are used in the art. The trim cover is attached to the foam device by aligning the metal wire in the foam device with the hard plastic bead in the trim cover and thereafter engaging the two with a metal ring. Typically, the metal ring is deployed from a so-called hog-ring gun. This approach has been used for many years to secure a trim

10 cover to a foam device. This approach suffers from a number of drawbacks. For example, a significant capital cost is required to acquire the hog-ring gun and a significant associated labour cost is required to ensure that trim covers can be attached to foam devices at a rate commensurate with the rate at which the foam device is being produced. Further, since deployment of the first hog-ring

15 immovably secures the trim cover to the foam device, there is no play or give. The result of this is that perfect placement of the trim cover over the foam device must be achieved prior to deployment of the first hog ring to avoid significant loss of efficiency. Still further, this approach is difficult to use reliably when producing a vehicular seat product which incorporates one or more of a seat heater and an

20 occupant detection system. Still further, the use of metal in the foam device creates additional cost in recycling the finished product after completion of its life cycle. A modification of this approach is to replace the metal wire typically molded into the A-surface of the foam device with a mounting device made of foam – see, for example, Canada patent application 2,165,930 [Grund et al.], published on June 24,

25 1996 and DE 44 46 450 C1 [Johnson Controls GmbH & Co.], granted April 4, 1996. Another modification of this approach is to utilize a mechanical clip to connect the trim cover to the metal wire molded into the A-surface of the foam device – see, for example DE 195 30 379 C2 [Johnson Controls GmbH & Co.], published December 19, 1996.

30 Second it is known to utilize a plurality of independent or single mechanical clips to secure the trim cover to the foam device. In this approach, a series of mechanical clips is molded in the A-surface of the foam device. Each mechanical clip typically comprises a base which is molded into the foam and a receptacle or

clip portion which emerges from the foam at selected locations on the A-surface of the foam device. See, for example, one or more of the following prior art references:

DE 299 17 372 U1 [Johnson Controls GmbH & Co.], published  
5 February 24, 2000; and

DE 298 21 697 U1 [Bertrand Faure Sitztechnik GmbH & Co.],  
published March 25, 1999.

For a typical vehicular seat component (e.g., a seat bottom or a seat back), it is common to require 12-30 of these clips to be molded into the foam device. This approach suffers from a number of drawbacks. For example, it is very difficult to  
10 achieve optimal alignment of the individual clips using this approach. This results in production of an unsightly product. Further, this approach requires significant time to correctly dispose the individual clips in the mold. This results in one or both of low efficiency and increased labour.

15 Third, it is known to use so-called Velcro<sup>TM</sup>-type fasteners to attach a trim cover to a foam device. These fasteners are also known in the art as touch fasteners or "hook and loop" fasteners. While this approach is reliable, it does suffer from a number of drawbacks. For example, the this type of fastener is generally regarded one of the most expensive approaches to utilize to secure a trim cover to a foam  
20 device. Further, this approach is not well suited to fastening around a curve portion of the foam device without incurring significant wastage. Third, in many applications, the use of this approach necessitates the use of a wide fastener to achieve sufficient pullout strength. The result of this is a relatively wide trench which results in a relatively unsightly product.

25 Fourth, from United States patent 5,641,552 [Tillner], it is known to utilize an anchoring strip which is molded in A-surface of the foam device. The anchoring strip is in the form a wide, flat connecting bar made of a molded plastic body (polypropylene is provided as an example) and having a series of C-clips disposed at various spots along its length. The wide, flat connecting bar is described as being  
30 flexible perpendicular to its main plane. It is clear that this is the only moment of flexibility of the wide, flat connecting bar. This approach has a number of

drawbacks. For example, the anchoring strip is not well suited to being used around corners and, for most cost-efficient applications, is really only applicable in straight lengths. Further, if the final product is a vehicle seat, the use of a wide, flat connecting bar made of plastic deleteriously affects comfort. Still further, demolding a foam part having a wide, flat connecting bar of this an anchoring strip is difficult to achieve reliably without tearing out of a portion of the anchoring bar from the A-surface of the foam part. Still further, it is impractical and, in most cases, not possible, to mold the anchoring strip in to foam without fouling of the C-clips.

British patent application 2,238,708A [White] teaches a device for attaching material to a seat in a manner similar to the device taught by Tillner. The device is in the form of a rail having one or more clip members which form an open loop. A flat vertical connecting portion is interposed between the rail and the one or more clip members such that the clip portion and the rail are remote from one another.

This approach has a number of drawbacks. First, the device taught by White is not easily useable in a commercial setting due to the fact that there is no place on the rail which provides a convenient press point for insertion of the device in a mold. In fact, White is completely silent on how the device is to be used in a mold or on a mold therefore. This disadvantage is exacerbated by the presence of the flat vertical connecting portion between the rail and the one or more clip members rendering the device cumbersome to insert in a mold. Second, the distance between the rail and the clip member(s) is too large to allow the device to be conveniently used in a process and to allow the device to be molded into many conventional dimensioned foam elements. On the latter point, for example, in a conventional vehicular seat, the thickness of the seat in the location of the trenches is about 20 to about 25 mm. This dimension renders the device taught virtually unusable as taught by White.

Thus, despite the advances made to date, there is still room for improvement. Specifically, it would be advantageous to have an attachment device which obviates or mitigates and least one of the above-mentioned drawbacks of the prior art. It would be particularly advantages if the attachment device was not only well suited for attachment of a trim cover to a resilient body but could also be use to attach other elements to the resilient body.

DISCLOSURE OF THE INVENTION

It is an object of the present invention to provide an attachment device, preferably a trim cover attachment device, which obviates or mitigates at least one of the above-mentioned disadvantages of the prior art.

5 It is another object of the present invention to provide a novel resilient device incorporating the present attachment device, more preferably a trim cover attachment device.

It is another object of the present invention to provide a novel foam device incorporating the present attachment device, more preferably a trim cover  
10 attachment device.

It is yet another object of the present invention to provide a novel process for production of the present resilient device.

It is yet another object of the present invention to provide a novel mold for production of the present resilient device.

15 Accordingly, in one of its objects, the present invention provides an attachment device comprising a plurality of female attachment portions interconnected to one another by at least one connecting portion, the attachment device being flexible in at least two independent planes, each female attachment portion comprising a receptacle portion and a base portion connected to the  
20 connecting portion, the base portion having a lateral dimension greater than a lateral dimension of the receptacle portion.

In another of its aspects, the present invention provides an elongate attachment device having a longitudinal axis, the device comprising:

a plurality of female attachment portions, each female attachment portion  
25 comprising a receptacle portion having a first lateral dimension substantially orthogonal to the longitudinal axis and a base portion connected to the connecting portion, the base portion having a second lateral dimension substantially orthogonal to the longitudinal axis, the second lateral dimension being greater than the first lateral dimension;

at least one elongate flexible portion interconnecting the plurality of attachment portions, the at least one elongate flexible portion having a third lateral dimension substantially orthogonal to the longitudinal axis;

wherein second lateral dimension is greater than the third lateral dimension.

5 In yet another of its aspects, the present invention provides a resilient device comprising a resilient body and the present attachment device secured with respect to one another.

In yet another of its aspects, the present invention provides a foam device comprising a foam body and the present attachment device secured with respect to  
10 one another.

In yet another of its aspects, the present invention provides a process for producing a foam device incorporating an attachment device comprising a plurality of female attachment portions interconnected to one another by at least one connecting portion, the attachment device being flexible in at least two independent  
15 planes, each female attachment portion comprising a receptacle portion and a base portion connected to the connecting portion, the base portion having a lateral dimension greater than a lateral dimension of the receptacle portion, the process comprising the steps of:

disposing the attachment device in a mold comprising a first mold portion  
20 and a second mold portion releasably engageable to define a mold cavity;

dispensing at least one of an expandable polymeric composition and expanded polymer particles in at least one of the first mold portion and the second mold portion;

closing the first mold portion and the second mold portion;

25 expanding the expandable polymeric composition or adhering the expanded polymer particles to each other to substantially fill the mold cavity and to at partially encompass at least a portion of the attachment device; and

obstructing foam entry into the plurality of attachment portions.

In yet another of its aspects, the present invention provides a process for  
30 producing a foam device incorporating an elongate attachment device having a longitudinal axis, the device comprising: a plurality of female attachment portions,

each female attachment portion comprising a receptacle portion having a first lateral dimension substantially orthogonal to the longitudinal axis and a base portion connected to the connecting portion, the base portion having a second lateral dimension substantially orthogonal to the longitudinal axis, the second lateral dimension being greater than the first lateral dimension; at least one elongate flexible portion interconnecting the plurality of attachment portions, the at least one elongate flexible portion having a third lateral dimension substantially orthogonal to the longitudinal axis; wherein second lateral dimension is greater than the third lateral dimension, the process comprising the steps of:

10 disposing the attachment device in a mold comprising a first mold portion and a second mold portion releasably engageable to define a mold cavity;

dispensing at least one of an expandable polymeric composition and expanded polymer particles in at least one of the first mold portion and the second mold portion;

15 closing the first mold portion and the second mold portion;

expanding the expandable polymeric composition or adhering the expanded polymer particles to each other to substantially fill the mold cavity and to at partially encompass at least a portion of the attachment device; and

obstructing foam entry into the plurality of female attachment portions.

20 In yet another of its aspects, the present invention provides a mold for producing a resilient device incorporating an attachment device comprising a plurality of attachment portions interconnected to one another by at least one connecting portion, the mold comprising:

a first mold portion and a second mold portion releasably engageable to  
25 define a mold cavity; and

a retainer for the attachment device, the retainer comprising: a plurality of receptacles for receiving each of the plurality of attachment portions so as to align the attachment device in a predetermined manner, and means to retain the attachment device in place during expansion of an expandable foam composition in  
30 the mold cavity.

The present inventors have developed an attachment device, preferably a trim cover attachment device, having a combination of some or all of the following advantages:

- relatively efficient to “load” on the mold,
- 5      • can be made of polymer to facilitate recyclability of the final product,
- relatively inexpensive,
- does not require the use of expensive and/or dangerous equipment attach the trim cover (or other element) thereto,
- 10      • can be used to attach a trim cover (or other element) to a foam device around a curved portion,
- can be easily used to provide straight-line attachment of the trim cover (or other element) to the foam device,
- 15      • can provide some play or give during initial and final attachment of the trim cover (or other element) to the foam device,
- can be used to secure a trim cover (element) to a foam device with adversely affecting other elements of the foam device (e.g., heating elements, occupant detection systems and the like),
- 20      • can be used facilitate original assembly and subsequent disassembly of the foam device for maintenance or any other purpose,
- can be deployed in relatively narrow trenches without compromising pull-out strength, and
- does not render the final foam product difficult to demold.

25      The attachment device comprises a plurality of attachment portions. The attachment portions are interconnected to one another by at least one connecting



portion, preferably at least one flexible connecting portion. The attachment device is flexible in at least two independent planes. Thus, unlike the Tillner attachment device discussed above, which is flexible only in a direction perpendicular to the main plane of the connector bar, the present attachment is flexible in at least two independent planes. In most cases, the present attachment device will be flexible in more than two independent planes. Further, unlike the White attachment device discussed above, the lateral dimension of the base portion of the present attachment device allow the present attachment device to be readily adapted to use in a commercial setting (i.e., the present attachment device is much simpler to "load" or dispose in a mold). Further, by not having the receptacle portion and the base portion in the present attachment device significantly separated as shown in White, it is possible to incorporate the present attachment device in conventionally dimensioned foam elements such as vehicular seats.

Flexibility may be conferred to the attachment device in a number of different ways, such as: (i) selection of the appropriate material or materials, (ii) the geometry of the connecting portions between the attachment portions, (iii) the mode of securing the connecting portions to the attachment portions, (iv) the relative geometry of the connecting portions and the attachment portions, or (v) any combination of any of (i), (ii), (iii) and (iv).

In a preferred embodiment, flexibility may be conferred by the provision of a plurality of attachment portions, each attachment portion comprising a female attachment portion attached to a base portion. The base portion has a larger surface area than the surface area of the female attachment portion adjacent or attached thereto. The plurality of attachment portions are interconnected by one or more connecting portions, preferably one or more flexible connecting portions. The lateral dimension of the base portion is greater than the lateral dimension of the one or more connecting portions.

The present attachment device comprises a plurality of attachment portions (also referred to in some cases in this specification as female attachment portions). The precise number of such portions is not particularly restricted and depends, at least in part, on the overall dimensions and shape of the finished product. In most cases, the present attachment device, when used in a trim cover attachment

application, will comprise from 2 to 10, more preferably from 4 to 8, trim cover attachment portions. Typically, a connecting portion, preferably a flexible connecting portion will interconnect adjacent pairs of attachment portions.

5 The present attachment system is particularly well suited to be incorporated in a resilient device such as a foam element to a trim cover may be secure and the finished product utilized as a component of a vehicular seat. While use of the present attachment device as a trim cover attachment device is highly preferred, those of skill in the art will readily appreciate the present attachment device may be used in a multitude of other applications. For example, it is possible to utilize the  
10 present attachment device to attach components other than a trim cover to a resilient body. Such other components may include heating elements, occupant detection systems, load sensors, conduits for air passageways (e.g., for use in a climate control vehicular seat), auxiliary resilient elements (e.g., multiple hardness foam elements) and like. Further, when the present attachment device is used in a vehicular seat  
15 application, it may be used to attach another to any surface of the resilient body (i.e., A-surface, B-surface, etc.). Thus, while the following description of the preferred embodiments of the present attachment device refers to a trim cover attachment device (a highly preferred application of the invention), the scope of the invention is not to be construed as limited to the use of the present attachment device solely in  
20 trim cover attachment applications.

As used throughout this specification, the term "receptacle portion" is intended to mean that portion of the attachment device which receives the attachment element of the device which is to be attached (e.g., the trim cover). Further, as used throughout this specification, the term "locking portion" is intended  
25 to mean that portion of the attachment device which retains in the attachment device the attachment element of the device which is to be attached (e.g., the trim cover).

#### BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the present invention will be described with reference to the accompanying drawings in which like reference numerals denote like elements and  
30 in which:

Figure 1 illustrates a perspective view of first embodiment of the present trim cover attachment device;

Figure 2 illustrates an enlarged perspective view of second embodiment of the present trim cover attachment device;

5        Figure 3 illustrates an enlarged perspective view of third embodiment of the present trim cover attachment device;

Figure 4 illustrates a perspective view of attachment of a trim cover to the trim cover attachment device illustrated in Figure 1;

10       Figure 5 illustrates a section view of attachment of a trim cover to the trim cover attachment device illustrated in Figure 1 which has been molded into a foam element;

Figure 6 illustrates a sectional view of a mold for producing a foam element incorporating the present trim cover attachment device;

15       Figure 7 illustrates a perspective view of attachment of a trim cover to the element produced in the mold of Figure 6;

Figure 8 illustrates a perspective view of a fourth embodiment of the present trim cover attachment device;

20       Figure 9 illustrates an enlarged perspective view of the trim cover attachment device illustrated in Figure 8 as it would be retained in mold like the one illustrated in Figure 6;

Figure 10 illustrates a sectional view along line X-X in Figure 9;

25       Figure 11 illustrates a perspective view of how a portion of the trim cover attachment device illustrated in Figure 8 would be retained in a mold like the one illustrated in Figure 6 to obviate or mitigate ingress of foam material into the trim attachment portion of the trim cover attachment device;

Figures 12 is similar to Figure 9 with addition of a molded foam element encompassing a portion of the trim cover attachment device;

Figure 13 illustrates the product shown in Figure 12 after it has been demolded; and

Figures 14-16 illustrate various view of use of a trim cover attachment device which is a hybrid of the trim cover attachment devices illustrated in Figure 2 and Figure 8.

### BEST MODE FOR CARRYING OUT THE INVENTION

With reference to Figures 1, 4 and 5, there is illustrated a trim cover attachment device 100. Trim cover attachment device 100 comprises a series of trim cover attachment portions 110 which are interconnected by a series of flexible portions 120. Each trim cover attachment portion 110 comprises a base 130 and a female attachment portion 140. As illustrated, base 130 has a generally rectangular shape and a larger surface area than the surface area of female attachment portion 140 which is attached to base 130.

Female attachment portion 140 is generally U-shaped and comprises a pair of generally upstanding walls 150 between which is defined a receptacle portion 155. Walls 150 are reversibly movable with respect to one another – e.g., they may be biased toward or away from each other. As illustrated, for each female attachment portion 140, walls 150 are generally mirror images of one another along an axis perpendicular to the longitudinal axis of trim cover attachment device 100. In the distal region of each wall 150 there is provided a hook 160 which acts as an element of the locking portion of attachment device 100.

As shown in Figure 1, trim cover attachment device 100 is flexible in at least two planes. Plane #1 contains the major surface of base 130 and the flexibility of trim cover attachment device 100 in this plane is shown with reference to Arrows A. Plane #2 is orthogonal to plane #1 and the flexibility of trim cover attachment device 100 in this plane is shown with reference to Arrows B. Of course those of skill in the art will recognize that trim cover attachment device 100 may be flexible in one or more planes beyond plane #1 and plane #2.

With reference to Figures 2 and 3, there are illustrated alternate embodiments to the trim cover attachment device illustrated in Figures 1, 4 and 5. For ease of

understanding, reference numerals in Figures 1-5 have the same final two digits denote like elements. For example, female attachment portion 140, 240 and 340 is the same element in Figures 1-5.

With reference to Figure 2, there is illustrated a trim cover attachment device 200. The principal difference between trim cover attachment device 200 and trim cover attachment device 100 illustrated in Figures 1, 4 and 5 is the provision of curved or non-linear flexible portion 220 in trim cover attachment device 200 (i.e., flexible portions 120 of trim cover attachment device 100 are straight sections). As illustrated in Figure 2, flexible portion 220 is curved out of plane #1 described above (i.e., the plane which, in Figure 2, would contain the major surface of base 230). Of course, those of skill in the art will recognize that flexible portion 220 may curved in a multitude of other directions.

With reference to Figure 3, there is illustrated a trim cover attachment device 300. One difference between trim cover attachment device 300 and trim cover attachment device 100 illustrated in Figures 1, 4 and 5 is the provision of base 330 in trim cover attachment device 300 having a hexagonal shape and have disposed at opposed locations a pair of receptacles. Another difference between trim cover attachment device 300 and trim cover attachment device 100 illustrated in Figures 1, 4 and 5 is the provision of utilizing flexible portion 320a or 320b in trim cover attachment device 300. Each of flexible portions 320a and 320b comprise at opposed ends thereof a pair of pins 325. Pins 325 are size to fit snugly into receptacles 335 on base 330. Thus, as will be appreciated by those of skill in the art, trim cover attachment device 300 allows for on-site customisation of the distance between adjacent pairs of trim cover attachment portions 310. The amount of customisation can be easily controlled by the number of lengths of flexible portions 320a, 320b, etc. which are stocked. It is possible to modify pins 325 and receptacles 335 to include define a ball and socket joint (e.g., pins 325 could be modified to include the "ball" and receptacles 335 could be modified to include the "socket") once assembled. This would serve to increase flexibility of trim cover attachment device 300.

With further reference to Figures 4-5, use of trim cover attachment device 100 to secure a trim cover 10 is illustrated. Thus, trim cover 10 comprises a cover

stock material 15. As is known in the art cover stock material 15 may be made of leather, cloth, vinyl and the like. A pocket 20 is attached to cover stock material 15 via stitching 25. Disposed with pocket 20 is a rod 30. Rod 30 may be made of plastic or any other suitable material. When it is desired to attach trim cover 10 to trim cover attachment device 100, rod 30 is moved in the direction of Arrow C. The surface of pocket 20 adjacent rod 30 contacts hooks 160 of trim cover attachment device 100. With continued urging of rod 30 in the direction of Arrow C, walls 150 are biased open to allow rod 30 to clear hooks 160 and enter receptacle portion 155. Once hooks 160 are cleared by rod 30, walls 150 return to the resting state and rod 30 is received by receptacle portion 155 and retained female attachment portion 140 by hooks 160 (these elements serve as the locking portion). Those of skill in the art will recognize that rod 30 may be modified to have a non-circular cross-sectional shape or may be substituted with a strip having a barb-shaped or arrow-shaped profile.

With particular reference to Figure 5, trim cover attachment device 100 is illustrated as incorporated in a foam element 50. As illustrated, flexible portion 120 and base 130 are embedded below a surface foam element 50, and walls 150 emerge upwardly into a trench 55 disposed in foam element 50.

With reference to Figure 6, there is illustrated a sectional view of a mold 60. Mold comprises a bowl 62 and a lid 64 which swings about a hinge 66. The lower surface of bowl 62 corresponds to the A-surface of the finished foam part and includes a pair of platforms 68. Platforms 68 retain trim cover attachment device 100 in a manner which will be discussed below. When it is desired to produced foam element 50, lid 64 of mold 60 is placed in the open position. Trim cover attachment devices 100 are retain in platforms 68 and a liquid foamable polymeric composition is dispensed in bowl 62.

Thereafter, lid 64 is closed in the direction Arrow D and the foam composition expands to fill the mold cavity. Once expansion is complete, lid 64 is opened and foam element 50 is removed or demolded from bowl 62. Trim cover 10 may then be secured to trim cover attachment device 400 (this device will be described below) as described above with references to Figures 4 and 5 – this is shown schematically in Figure 7.

With reference to Figures 8-13, there is illustrated a highly preferred embodiment of the present trim cover attachment device, name a trim cover attachment device 400. For ease of understanding, reference numerals in Figures 1, 4, 5 and 8-13 have the same final two digits denote like elements. For example, base 130 and 430 are the same element in Figures 1-5 and 8-13.

The principal difference between trim cover attachment device 100 and trim cover attachment device 400 is the provision of retention members 470 on the outside of walls 450 of trim cover attachment device 400.

Trim cover attachment device 400 is well suit to shielding of female attachment portion 440 during the foaming operation. This may be done through the use of a receptacle 70 disposed on platform 68 of bowl 62. Receptacle 70 comprises an opposed pair of lugs 72. As shown in Figure 9, as female attachment portion 440 is pushed into receptacle 70, the distal portions of walls 450 contact lugs 72. Walls 450 are then biased toward each other until they clear lugs 72. This action serves to urge or otherwise secure base 430 against the upper surface 74 of receptacle 70 with two resultant advantages: (i) ingress of foam into receptacle 70 is obviated or mitigate thereby avoiding fouling female attachment portion 440 – i.e. effective seal is formed, and (ii) trim cover attachment device 400 will not “float” or “swim” away from platform 68 as the liquid foamable polymeric compositions expands and begins to engulf flexible portions 420 and base 430. Figure 11 illustrates a schematic of how female attachment portion 440 is encompassed by the combination of receptacle 70 and base 430.

The resultant foam part 50 is shown in-mold in Figure 12 and de-molded in Figure 13. As illustrated in Figures 9 and 12, upper surface 74 of receptacle 70 is raised with respect to platform 68 of bowl 62. This facilitates having foam element 50 encompass flexible portions 420 and bases 430 of trim cover attachment device 400 thereby improving the pull-out strength of the latter.

With reference to Figures 14-16 there is illustrated use of a trim cover attachment device which is a “hybrid” of trim cover attachment device 200 (as to curved or non-linear flexible portions 220) illustrated in Figure 2 and trim cover attachment device 400 (as to all elements except flexible portion 420) illustrated in

Figure 4. For ease of understanding, Figures 14-16 utilize the appear reference numerals to denote the respective elements from trim cover attachment device 200 and trim cover attachment device 400. The use of the "hybrid" trim cover attachment device is the same as discussed above with reference to Figures 8-13.

5 One difference is that platform 69 of bowl 62 is designed to have the same height as receptacle 70 in the space between adjacent receptacles 70. The result is that bases 430 are not complete engulfed by foam element 50. Pullout is not deleteriously compromised, however, due to the presence of curved or non-linear flexible portions 220 which serve to anchor the trim cover attachment device in foam element 50.

10 While this invention has been described with reference to illustrative embodiments and examples, the description is not intended to be construed in a limiting sense. Thus, various modifications of the illustrative embodiments, as well as other embodiments of the invention, will be apparent to persons skilled in the art upon reference to this description. For example, it is possible to modify the specific  
15 process discussed above to utilize expanded polypropylene beads (or any other expanded polymer beads) during which individual beads would be adhered together to produce a molded part without necessarily expanding individual beads. It is therefore contemplated that the appended claims will cover any such modifications or embodiments.

20 All publications, patents and patent applications referred to herein are incorporated by reference in their entirety to the same extent as if each individual publication, patent or patent application was specifically and individually indicated to be incorporated by reference in its entirety.

25



What is claimed is:

1. An attachment device comprising a plurality of female attachment portions interconnected to one another by at least one connecting portion, the attachment device being flexible in at least two independent planes, each female attachment portion comprising a receptacle portion and a base portion connected to the connecting portion, the base portion having a lateral dimension greater than a lateral dimension of the receptacle portion.
2. The attachment device defined in claim 1, wherein the base portion has a larger surface area than a surface area of the female attachment portion attached thereto.
3. The attachment device defined in claims 1-2, wherein the receptacle portion comprises a substantially U-shaped cross-section.
4. The attachment device defined in claim 3, wherein the U-shaped cross-section comprises a pair of generally upstanding walls for receiving an attachment portion of an element to be attached.
5. The attachment device defined in claim 4, wherein a distal portion of each of the upstanding walls comprises a locking portion for engaging the attachment portion of the element to be attached.
6. The attachment device defined in claim 5, wherein the locking portion comprises a first lateral portion projecting substantially toward the receptacle portion.
7. The attachment device defined in claim 6, wherein the first lateral portion projects angularly with respect to the pair of generally upstanding walls.
8. The attachment device defined in claims 4-7, wherein each of the pair of generally upstanding walls comprises a second lateral section projecting substantially away from the receptacle portion.

9. The attachment device defined in claims 1-2, wherein the receptacle portion comprises a substantially C-shaped cross-section.

10. The attachment device defined in claims 1-9, wherein the attachment portions and the at least one connecting portion are integrally formed.

5 11. The attachment device defined in claims 1-9, wherein the attachment portions and the at least one connecting portion are detachably connected.

12. The attachment device defined in claims 1-11, wherein a connecting portion interconnects a pair of attachment portions at a pair of joints, wherein each of the joints is rotatable.

10 13. The attachment device defined in claims 1-12, wherein the at least one connecting portion is substantially straight.

14. The attachment device defined in claims 1-12, wherein the at least one connecting portion is bent.

15 15. An elongate attachment device having a longitudinal axis, the device comprising:

20 a plurality of female attachment portions, each female attachment portion comprising a receptacle portion having a first lateral dimension substantially orthogonal to the longitudinal axis and a base portion connected to the connecting portion, the base portion having a second lateral dimension substantially orthogonal to the longitudinal axis, the second lateral dimension being greater than the first lateral dimension;

at least one elongate flexible portion interconnecting the plurality of attachment portions, the at least one elongate flexible portion having a third lateral dimension substantially orthogonal to the longitudinal axis;

25 wherein second lateral dimension is greater than the third lateral dimension.

16. The attachment device defined in claim 15, wherein the receptacle portion comprises a substantially U-shaped cross-section.

17. The attachment device defined in claim 16, wherein the U-shaped cross-section comprises a pair of generally upstanding walls for receiving an attachment portion of an element to be attached.
18. The attachment device defined in claim 17, wherein a distal portion of each of the upstanding walls comprises a locking portion for engaging the attachment portion of the element to be attached.
19. The attachment device defined in claim 18, wherein the locking portion comprises a first lateral portion projecting substantially toward the receptacle portion.
20. The attachment device defined in claim 19, wherein the first lateral portion projects angularly with respect to the pair of generally upstanding walls.
21. The attachment device defined in claims 17-20, wherein each of the pair of generally upstanding walls comprises a second lateral section projecting substantially away from the receptacle portion.
22. The attachment device defined in claim 15, wherein the receptacle portion comprises a substantially C-shaped cross-section.
23. A resilient device comprising a resilient body and the attachment device defined in claims 1-22 secured with respect to one another.
24. The resilient device defined in claim 23, wherein the resilient body is selected from the group comprising a foam, a fibrous matrix and mixtures thereof.
25. The resilient device defined in claim 23, wherein the resilient body comprises a polyurethane foam.
26. A process for producing a foam device comprising the steps of:  
disposing the attachment device defined in claims 1-14 in a mold comprising a first mold portion and a second mold portion releasably engageable to define a mold cavity;

dispensing at least one of an expandable polymeric composition and expanded polymer particles in at least one of the first mold portion and the second mold portion;

closing the first mold portion and the second mold portion;

5       expanding the expandable polymeric composition or adhering the expanded polymer particles to each other to substantially fill the mold cavity and to at partially encompass at least a portion of the attachment device; and

obstructing foam entry into the plurality of attachment portions.

27.   The process defined in claim 26, wherein the expandable polymeric  
10   composition comprises a liquid foamable isocyanate-based polymer.

28.   The process defined in claims 26-27, wherein the expandable polymeric composition expands to encompass at least a portion of the at least one connecting portion of the attachment device.

29.   The process defined in claims 26-27, wherein the expandable polymeric  
15   composition expands to encompass substantially all of the at least one connecting portion of the trim cover attachment device.

30.   The process defined in claims 26-29, comprising the further steps of:  
removing the foam device from the mold; and  
securing a trim cover to the attachment device of the foam device.

20   31.   A process for producing a foam device comprising the steps of:  
disposing the attachment device defined in claims 15-25 in a mold comprising a first mold portion and a second mold portion releasably engageable to define a mold cavity;

dispensing at least one of an expandable polymeric composition and  
25   expanded polymer particles in at least one of the first mold portion and the second mold portion;

closing the first mold portion and the second mold portion;

expanding the expandable polymeric composition or adhering the expanded polymer particles to each other to substantially fill the mold cavity and to at partially encompass at least a portion of the attachment device; and

obstructing foam entry into the plurality of female attachment portions.

5 32. The process defined in claim 31, wherein the expandable polymeric composition comprises a liquid foamable isocyanate-based polymer.

33. The process defined in claims 31-32, wherein the expandable polymeric composition expands to encompass at least a portion of the at least one flexible portion of the attachment device.

10 34. The process defined in claims 31-32, wherein the expandable polymeric composition expands to encompass substantially all of the at least one flexible portion of the attachment device.

35. The process defined in claim 31-34, comprising the further steps of:  
removing the foam device from the mold; and  
15 securing a trim cover to the female attachment portion of the foam device.

36. The process defined in claim 35, wherein the trim cover comprises an attachment portion and the securing step comprises engaging the attachment portion with the female attachment portion of the attachment device.

20 37. The process defined in claims 31-36, wherein the obstructing step comprising disposing the female attachment portion of the attachment device in a receptacle having an upper surface against which the base portion abuts.

38. The process defined in claim 37, wherein base portion is disposed on the upper surface of the receptacle so as to provide a substantial seal against ingress of the expandable polymeric composition into the receptacle.

25 39. The process defined in claim 37, wherein the base portion is urged against the upper surface of the receptacle so as to provide a substantial seal against ingress of the expandable polymeric composition into the receptacle.

40. A mold for producing a resilient device incorporating an attachment device comprising a plurality of attachment portions interconnected to one another by at least one connecting portion, the mold comprising:

5 a first mold portion and a second mold portion releasably engageable to define a mold cavity; and

a retainer for the attachment device, the retainer comprising: a plurality of receptacles for receiving each of the plurality of attachment portions so as to align the attachment device in a predetermined manner, and means to retain the attachment device in place during expansion of an expandable foam composition in  
10 the mold cavity.

41. The mold defined in claim 40, wherein each receptacle comprises a pair of generally upstanding walls defining a receptacle locking region therebetween for receiving the attachment portion of the attachment device.

42. The mold defined in claim 41, wherein a portion of at least one of the  
15 upstanding walls comprises a receptacle locking portion for engaging the attachment portion of the attachment device.

43. The mold defined in claim 41, wherein a portion of each of the upstanding walls comprises a receptacle locking portion for engaging the attachment portion of the attachment device.

20 44. The mold defined in claims 42-43, wherein the receptacle locking portion comprises a first lateral portion projecting substantially toward the receptacle locking region.

45. The mold defined in claim 44, wherein the first lateral portion projects a generally orthogonal direction with respect to the pair of generally upstanding walls.

25 46. The mold defined in claims 40-45, wherein the receptacles are disposed in the first mold portion and the second mold portion comprises a plurality of urging pins to urge the attachment device against the receptacles.

47. The mold defined in claim 46, wherein the number of receptacles and urging pins is the same.

48. The mold defined in claim 47, wherein the each urging pin in the second mold portion is in substantial alignment with receptacle in the first mold portion.

5 49. An attachment device comprising a plurality of attachment portions, each attachment portion comprising female attachment portion and a base portion at opposed ends thereof, the base portions of adjacent female attachment portions being interconnected by at least one connecting portion, the base portion having a lateral dimension greater than or equal to a lateral dimension of the female  
10 attachment portion, the attachment device being flexible in at least two independent planes.

50. An attachment device comprising a plurality of attachment portions, each attachment portion comprising female attachment portion directly connected to a base portion, the base portions of adjacent female attachment portions being  
15 interconnected by at least one connecting portion, the base portion have a lateral dimension greater than or equal to a lateral dimension of the female attachment portion.

51. An elongate attachment device having a longitudinal axis, the device comprising:

20 a plurality of attachment portions, each attachment portion comprising a female attachment portion directly attached to a base portion, the base portion having a first lateral dimension substantially orthogonal to the longitudinal axis and a thickness dimension substantially orthogonal to the first lateral dimension;

at least one elongate flexible portion interconnecting the plurality of  
25 attachment portions, the at least one elongate flexible portion having a second lateral dimension substantially orthogonal to the longitudinal axis;

wherein: (i) the first lateral dimension is greater than the second lateral dimension, and (ii) the first lateral dimension is greater than the thickness dimension.

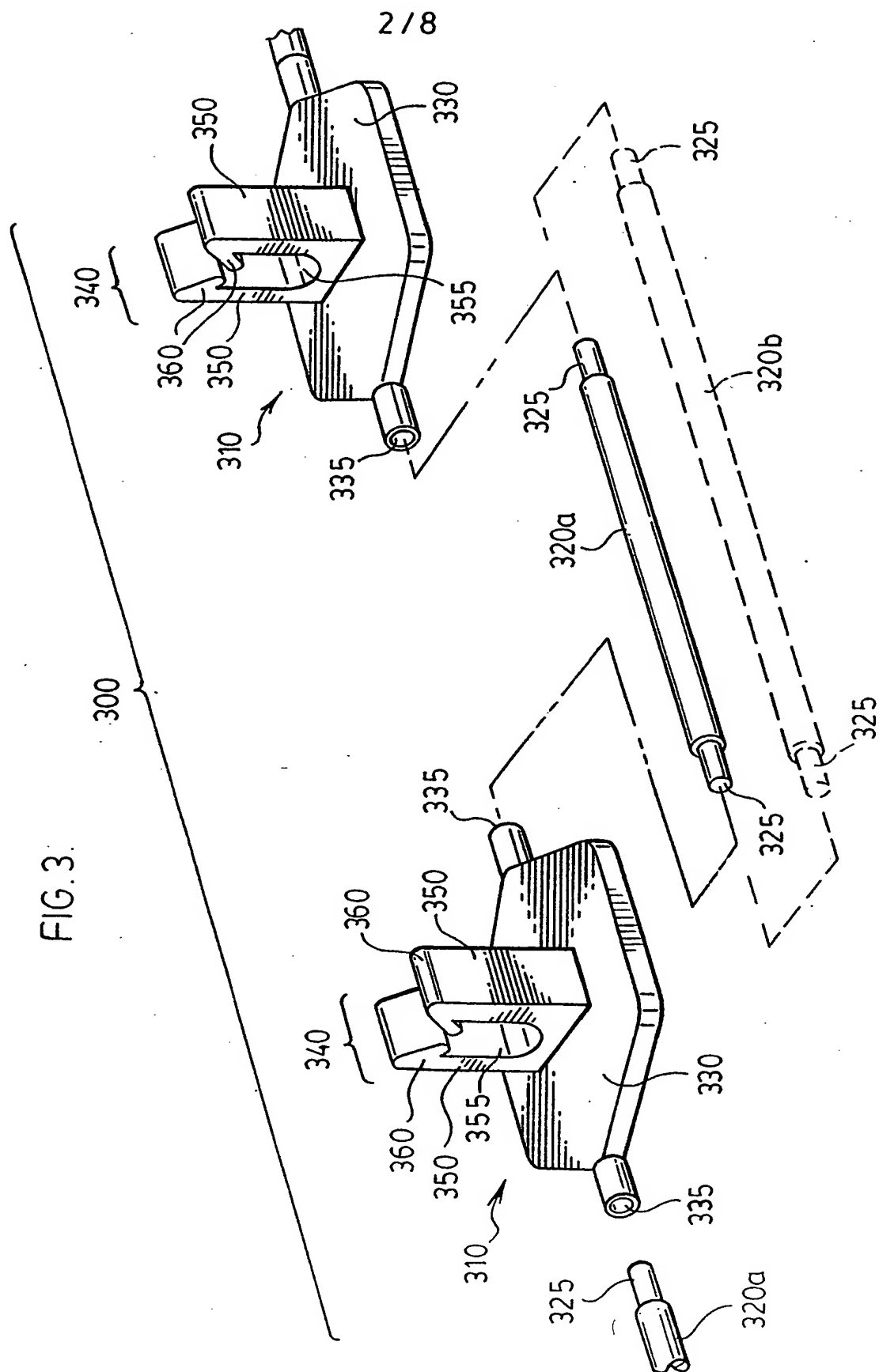
52. An attachment device comprising a plurality of attachment portions, each attachment portion comprising a female attachment portion and a base portion at opposed ends thereof, the base portions of adjacent female attachment portions being interconnected by at least one connecting portion, the base portion having a first lateral dimension which is: (i) greater than a thickness dimension substantially orthogonal to the first lateral dimension, and (ii) greater than or equal to a second lateral dimension of the female attachment portion.

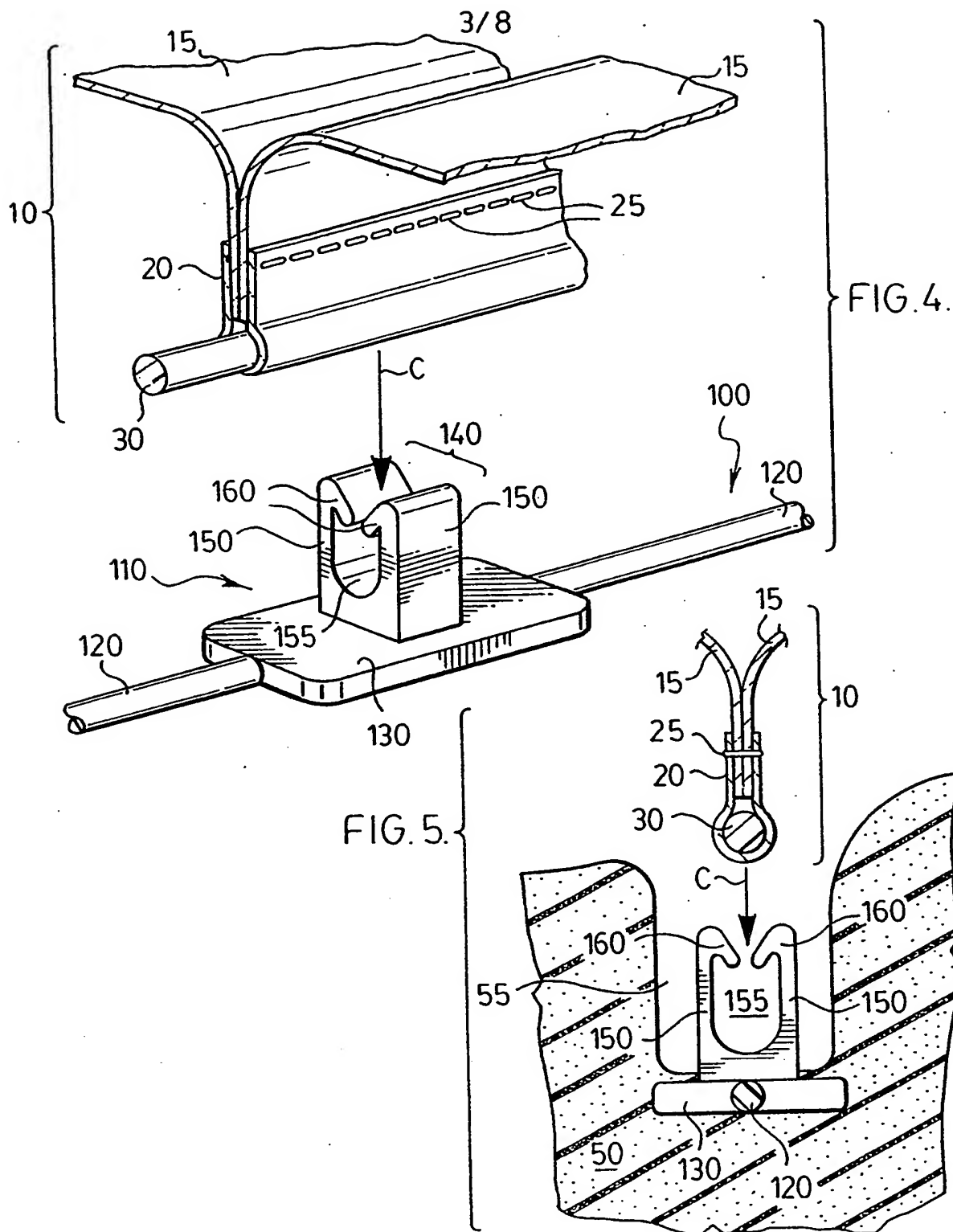
53. An attachment device comprising a plurality of attachment portions, each attachment portion comprising female attachment portion directly connected to a base portion, the base portions of adjacent female attachment portions being interconnected by at least one connecting portion, the base portion having: (i) a width greater than its thickness, and (ii) a width greater than a width of the at least one connecting portion.

54. An attachment device comprising a plurality of attachment portions, each attachment portion comprising female attachment portion directly connected to a base portion, the female attachment portion comprising a locking portion for engaging the attachment portion of the element to be attached, the base portions of adjacent female attachment portions being interconnected by at least one connecting portion, the base portion having: (i) a width greater than a width of the locking portion, and (ii) a width greater than a width of the at least one connecting portion.









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FIG. 11.

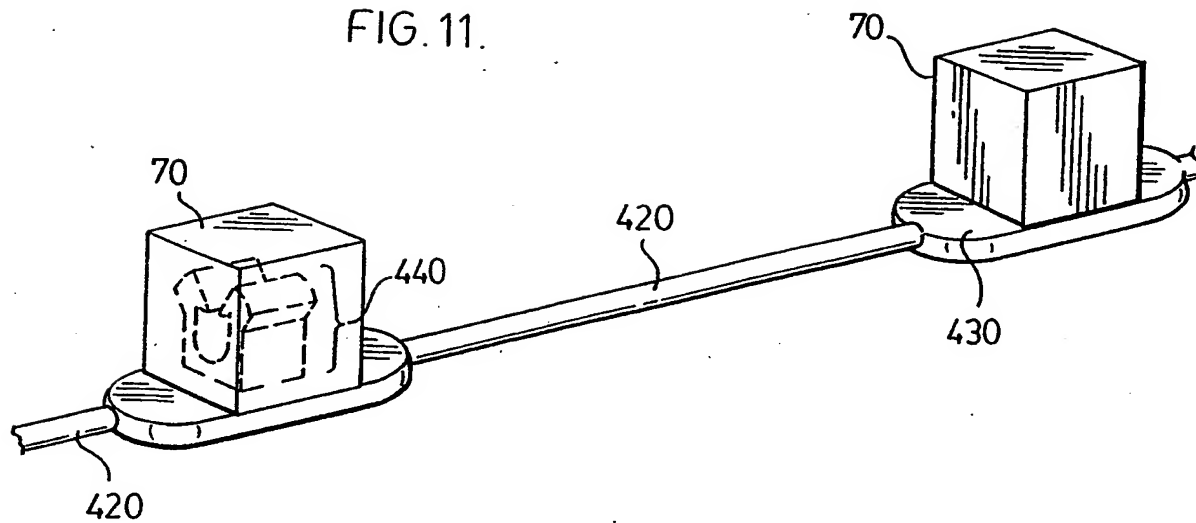
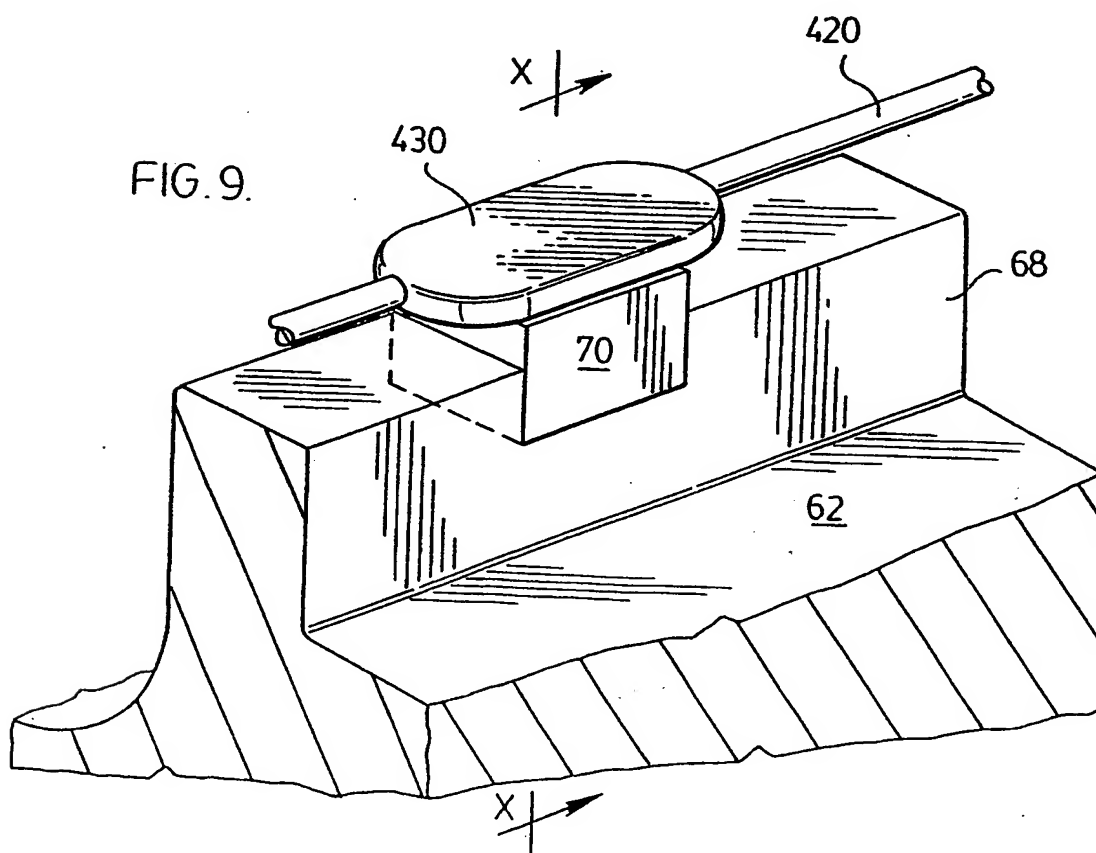


FIG. 9.



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FIG. 12.

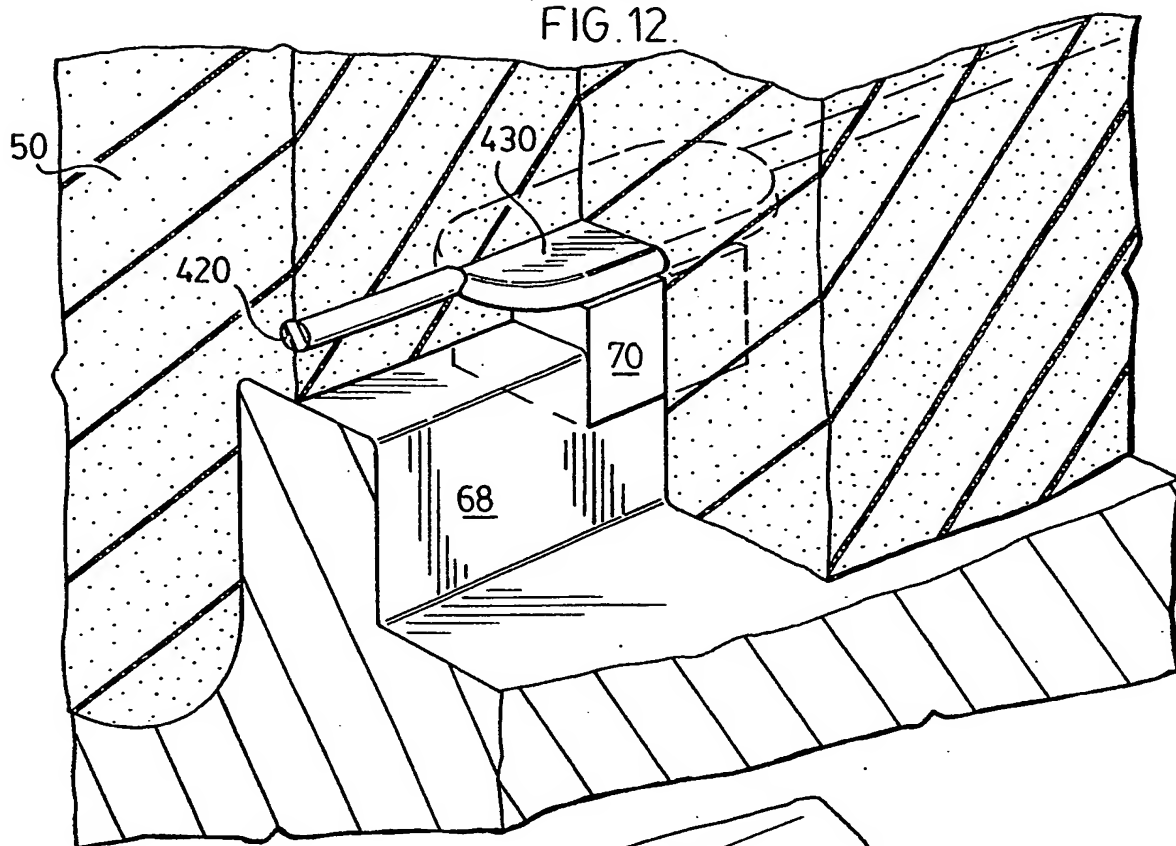
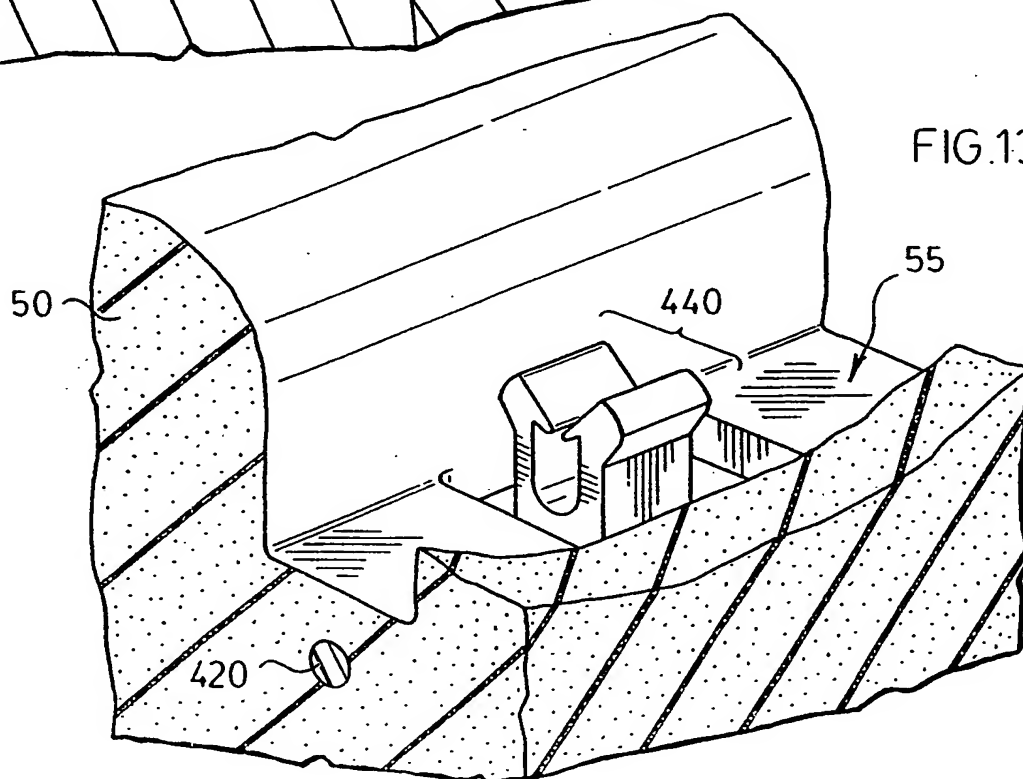
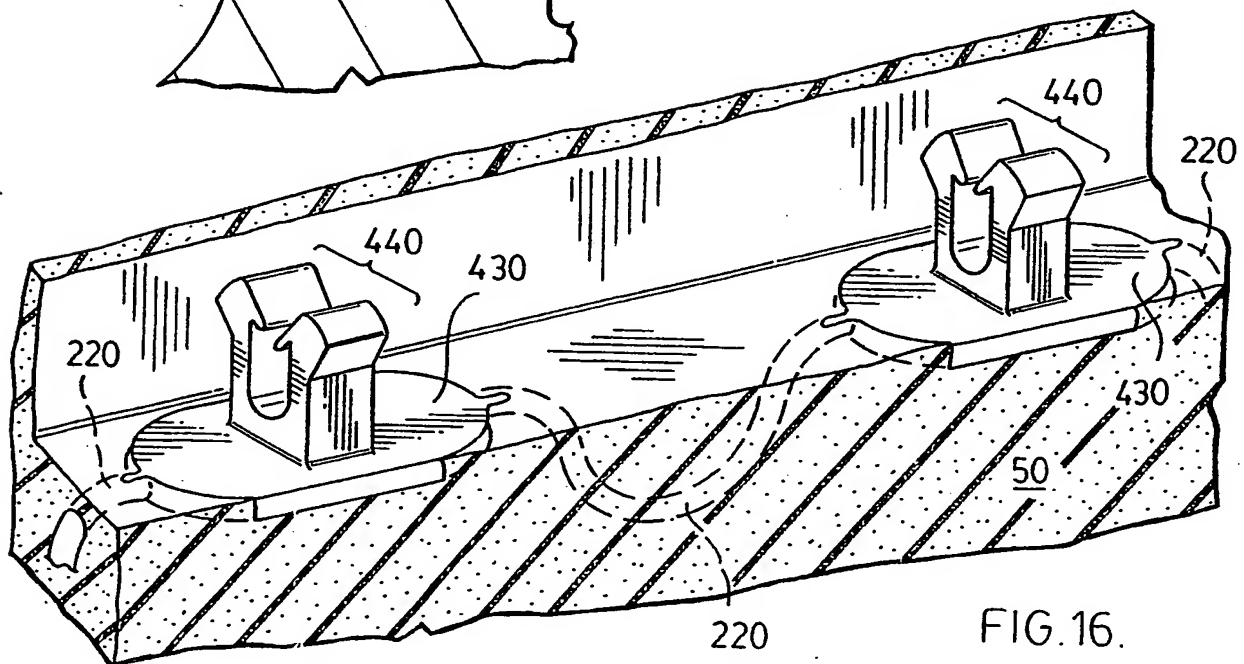
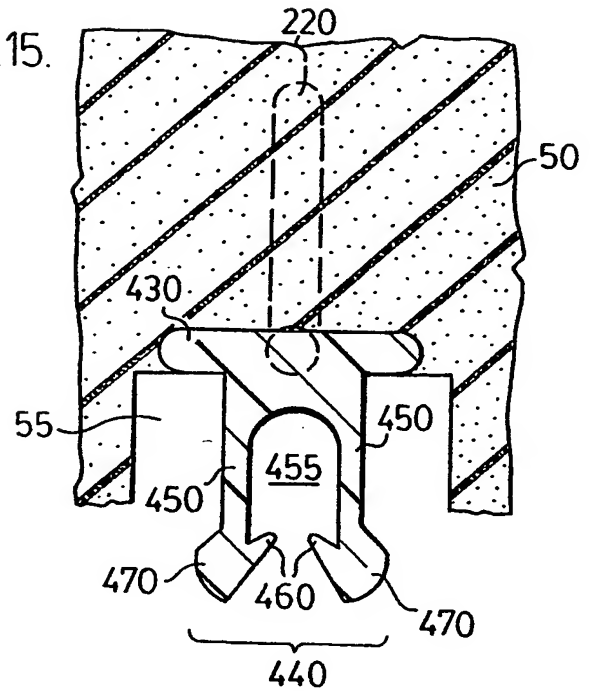
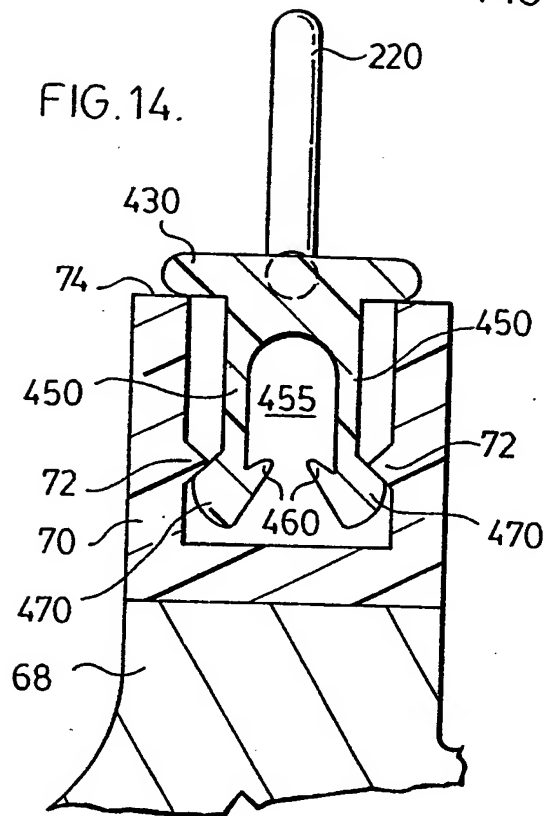


FIG. 13.



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FIG.15.



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